CLAIMS

What is claimed is:

1. An apparatus configured with a capability of setting a surface charge of an area on a substrate to a desired level, the apparatus comprising:

a column for generating an imaging electron beam and for directing the imaging beam to the area;

an electron flood gun for generating a flood electron beam and for directing the flood beam to the area;

a stage for holding the substrate; and

circuitry for controlling a stage bias voltage applied to the stage,

wherein the stage bias voltage is set prior to flooding the area so as to set the surface charge to the desired level.

2. The apparatus of claim 1, wherein the substrate comprises a semiconductor wafer.

3. The apparatus of claim 1, wherein the apparatus comprises an e-beam inspection/review tool.

4. The apparatus of claim 1, wherein the circuitry includes an isolation amplifier to isolate a generated bias voltage from the stage bias voltage applied to the stage.

5. The apparatus of claim 4, wherein the circuitry further includes a digital-to-analog converter and an amplifier to produce the generated bias voltage.

6. The apparatus of claim 5, wherein the circuitry further includes an attenuator that attenuates the generated bias voltage to form a stage bias readback signal that is input into an analog to digital converter.

7. The apparatus of claim 4, wherein the output of the isolation amplifier comprises a beam current readback signal that is input into an analog to digital converter.

8. The apparatus of claim 1, further comprising a charge sensor positioned in proximity to the area on the substrate for measuring the surface charge.

9. The apparatus of claim 8, wherein the charge sensor originates a charge readback signal that is input into an analog to digital converter.

10. The apparatus of claim 1, wherein the circuitry comprises a microcontroller configured to maintain control of the surface charge.

11. The apparatus of claim 10, wherein the microcontroller is coupled to the system controller by way of a communications interface.

12. A method of setting a surface charge of an area on a substrate to a desired level, the method comprising:

holding the substrate in a stage;

controlling a stage bias voltage applied to the stage; and

directing a flood of electrons to the area such that the surface charge of the area reaches an equilibrium at the desired level.

13. The method of claim 12, further comprising:

measuring the surface charge of the area.

14. The method of claim 13, further comprising:

determining if the surface charge of the area needs adjustment;

changing the stage bias voltage applied to the stage; and

re-flooding the area with electrons.

15. The method of claim 12, further comprising:

varying the stage bias voltage over a range of voltages; and

for each voltage in the range, flooding the area with electrons, and reading the surface charge, so as to determine a relationship between the stage bias voltage and the surface charge.

16. An apparatus configured with a capability to maintain focus of a main electron beam incident upon a substrate, the apparatus comprising:

a column configured to generate and direct the main beam towards an imaging area of the substrate;

an objective lens with a variable focal length that is configured to focus the main beam onto the imaging area;

a monitor beam gun configured to generate and direct a monitor electron beam towards a monitoring area of the substrate at a non-perpendicular incidence angle; and

an in-focus detector configured to detect an in-focus band in data collected from the monitor beam.

17. The apparatus of claim 16, wherein the incidence angle of the monitor beam is less than thirty degrees.

18. The apparatus of claim 16, wherein the in-focus detector detects the in-focus band by analyzing two-dimensional image data collected from the monitor beam.

19. The apparatus of claim 16, wherein the in-focus detector detects the in-focus band by analyzing edge content along one dimension collected from the monitor beam.

20. The apparatus of claim 16, wherein the imaging area and the monitoring area comprises a same area, and wherein the main beam does not impinge upon the area while the monitor beam is active.

21. A method of auto-focusing a main electron beam incident upon an imaging area of a substrate, the method comprising:

generating a monitor electron beam;

directing the monitor beam towards a monitoring area of the substrate at a non-perpendicular incidence angle;

detecting an in-focus band in data collected from the monitor beam; and

adjusting a focal length of an objective lens focusing the main beam based upon a position of the in-focus band.

22. The method of claim 21, wherein the imaging area and the monitoring area comprises a same area, and wherein the main beam does not impinge upon the area while the monitor beam is active.

23. The method of claim 21, wherein the imaging area and the monitoring area comprises separate areas.

24. The method of claim 21, wherein the incidence angle of the monitor beam is less than thirty degrees.

25. The method of claim 21, wherein the in-focus band is detected by analyzing two-dimensional image data collected from the monitor beam.

26. The method of claim 21, wherein the in-focus band is detected by analyzing edge content along one dimension collected from the monitor beam.

27. The method of claim 21, wherein the focal length is effectively adjusted by adjusting a stage bias level applied to a stage holding the substrate.

28. A method of setting a surface charge of an area on a substrate to a desired level and maintaining focus of a main electron beam incident upon the area, the method comprising:

holding the substrate in a stage;

controlling a stage bias voltage applied to the stage;

directing a flood of electrons to the area such that the surface charge of the area reaches an equilibrium at the desired level;

imaging the area with the main beam;

generating a monitor electron beam;

directing the monitor beam towards a monitoring area of the substrate at a non-perpendicular incidence angle;

detecting an in-focus band in data collected from the monitor beam; and

adjusting the stage bias voltage based upon a position of the in-focus band to effectively adjust the focus of the main beam.